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- (a) bleaching the chemical cellulose pulp in a first chlorine dioxide step at a temperature of over 70 °C and for less than 10 minutes, and adjusting the pH of the pulp in the first chlorine dioxide step so that the final pH of the step is over 4, then
 - (b) acid treating the chemical cellulose pulp from step (a) at a pH of between 2 – 5 and at a temperature of over 80°C for 30-300 minutes, and
 - (c) after (b) bleaching the chemical cellulose pulp in a second chlorine dioxide step; and

wherein (a) is further practiced so as to provide a chlorine dioxide dosage of between about 0.1-1.0% active chlorine during the first chlorine dioxide step; and wherein (c) is practiced so as to provide a chlorine dioxide dosage of between about 0.5-2.0% active chlorine during the practice of the second chlorine dioxide step.

REMARKS

Favorable reconsideration and allowance of this application are requested.

The independent claims pending in this application have been amended so as to more clearly define the present invention. Moreover, the term "about" which the Examiner objected to on page 6 of the Official Action has been deleted from claim 21.

Claims 21, 26-28, 30-32, 34 and 39 attracted a rejection alternatively under 35 USC 102(b) as anticipated by, or under 35 USC 103(a) as obvious over WO 91/05909 in view of WO 96/12063 or Bhattacharjee et al or Lachapelle.

On page 2 of the Office Action, the Examiner asserts that WO 91/05909 teaches bleaching in a first chlorine dioxide step by using 0.4-1.0 % chlorine dioxide. As applicants have explained in the response of December 18, 2000, there is a difference between chlorine dioxide usage where it is expressed as a percentage of active chlorine (as in the applicants' claims), and where it is expressed as a percentage of chlorine

dioxide with respect to the pulp (as in WO 91/05909). The conversion of chlorine dioxide given as a percentage of chlorine dioxide *with respect to the pulp*, must be multiplied by 2.63 in order to obtain a comparable percentage of active chlorine. For example, in Table 2 of WO 91/05909, where the percentage of chlorine dioxide is given as 0.4 to 1.0 % and, as noted above, is expressed as percentage of chlorine dioxide with respect to pulp, it must be multiplied by 2.63, which gives 1.05 to 2.63% active chlorine. However, it should be noted that these tests are carried out with the pulp, which is pretreated in a chlorination (CD) stage, that is, with chlorine and chlorine dioxide, the chlorine being the main chemical (see Table 3, Cl₂ 4.10 %, ClO₂ 0.46%). Thus, the process is not an elemental chlorine-free (ECF) process as recited in the present claims.

On page 3 of the Action, the Examiner asserts that WO 91/05909 teaches using sequences which include a second chlorine dioxide stage. Moreover, the Examiner refers to Tables 1-3 for chlorine dioxide dosage of 0.5-1.5 % in the first chlorine dioxide stage and 0.5-2.0 % in the second stage. However, applicants cannot find any such stages or charges in the Tables referenced by the Examiner. Instead, in every Table, there is first a chlorination stage which is **not** a chlorine dioxide stage as explained above. After the chlorination stage, the pulp is subjected to an alkaline (E) stage and then in D₁ stage, in the other E stage and D₂ stage. The whole bleaching sequence is therefore (CD)ED₁E D₂ (see also page 4, line 6 to 10). The pulp is washed between the stages. It should be noted that applicants do not claim a bleaching sequence having two D stages. Instead, the applicants' invention relates to a first D stage of a bleaching sequence, which stage is carried out in a specific way in more than one step.

The Examiner further asserts on page 3 of the Action that WO 96/12063 or Bhattacharjee or Lachapelle teach one to use chlorine dioxide instead of chlorine, in which case it would then be "obvious" to replace the CD(EO)DED process of WO 91/05909 with D(EO)DED. Applicants emphatically disagree.

In WO 91/05909 the first D stage is a first D stage after the (CD)E treatment. On page 2 of WO 91/05909 it is explained that in the sequence of (CD)(EO)DED, (CD) is a

chlorination stage, EO is a first bleaching stage, D₁ is a first bleaching stage, E₂ is a second alkaline extraction stage and D₂ is a second bleaching stage. On page 4 of WO 91/05909 it is said that the novel process can be used in the D₁ or D₂ stage of the (CD)(EO)DED bleaching sequence and as well as in any D bleaching stage of other three etc bleaching sequences. This means of course that if the (CD) stage were replaced with a D stage, WO 91/05909 does not teach or suggest to use its novel process in this D stage (which is called D₁₀₀ or D₀ in the art; see Lachapelle, page 181, left column), because according to the terminology of WO 91/05909 the CD stage is not a bleaching stage. Furthermore, on page 2, line 10-11, of WO 91/05909 it is clearly disclosed that the D₁ stage is a first bleaching stage. Thus, this WO reference teaches to use its novel process in the D stages which are the D₁ stage and later D stages (that is, D stages after the D₀ stage). In any case, WO 91/05909 does not teach or suggest the ClO₂ charges claimed by the present applicants. WO 91/05909 discloses only the ClO₂ charges for the D stage when the pulp is first treated in the (CD)E process (see Tables 1-3). Such charges are not relevant in the present invention relating to the first D stage of a sequence.

Bhattacharjee teaches that a sequence DEDED is replaced with a sequence DZDED or DZDZD. By using ozone (Z), the consumption of chlorine dioxide is reduced. Lachapelle uses hydrogen peroxide in order to reduce bleaching costs in a sequence D(EOP)D(EP)D. Even though the two references reveal that a chlorination stage can be replaced with a D stage, they do not teach or suggest any details of our claimed invention.

In the paragraph bridging pages 3 and 4 of the Action, the Examiner refers to WO 96/12063, page 10, in which it is stated that the acid treatment can be carried out before, during or after bleaching. Further he claims that it would be obvious to place the acid stage after the first D stage and before the second D stage in a DEDED sequence. It is on this basis that the applicants understand the Examiner to be rejecting claim 39. It should be noted, however, that in the sequence DEDED, there is an E stage between the D stages. In the stage of claim 39, there is no E stage between steps (a) –(c).

Therefore, to clarify the herein claimed subject matter, applicants have amended claim 39 so that in step b) it is defined that the pulp from step (a) is treated in step (b). In step (c) it is already disclosed that step (c) is effected after step (b). Step (a) – (b) are therefore clearly carried out without intermediate treatment therebetween.

The rejection of claims 22-24 and 35-37 under 35 USC §103(a) is based on combining Vuorinen et al with the other references discussed above. Vuorinen teaches (page 44, Abstract, first paragraph) that, because of its ene functionality, hexenuronic acid groups (HexA) react with several bleaching chemicals, such as chlorine dioxide. (HexA does not react with the ene functionality with hexenuronic acid groups, as stated in the Action, page 4). Vuorinen teaches that the reaction between HexA and ClO_2 can be prevented by removing HexA from pulp through an acid treatment. In claims 22 and 35 such an acid treatment is carried out after a D step. What applicants claim here is that step (a) is carried out so that HexA and ClO_2 do not substantially react and HexA is removed in step (b). Thus, in claims 22 and 35 it is done against the teachings of Vuorinen, because the acid treatment takes place **after** a D step.

Applicants note that Histed et al do **not** teach a chlorine dioxide step according to the present invention. The two minute reaction time disclosed in Histed et al is for a (CD) stage as made clear by the entire Histed et al disclosure, including the bold statement immediately after the title on Page 41 thereof.² Reference to the (CD) state is the "chlorination stage" in the left-hand columns of Table 1 on page 42 of Histed et al, the stage E being the extraction stage in the middle columns of Table 1, and the (HD) stage being the "hypochloride stage" in the right-hand columns of Table 1 of Histed et al.

Carles et al also is irrelevant to the claimed invention. Carles et al relate to a process for bleaching an oxygen or peroxide pre-oxidized paper pulp using a hot chlorination step with gaseous chlorine, an alkaline extraction step in the presence of an oxidizing agent of the hypochloride type, and then a chlorine dioxide step at a

² "In a well-equipped mill, a (CD) E (HD) sequence can give high brightness."

temperature of between about 60-90°C with a pH of between about 5 and 11 (see column 7, lines 54 through column 8, line 23 of Carles et al). The conditions in Carles et al must be evaluated with the entire Carles et al sequence in mind, and one cannot select from Carles et al an arbitrary feature or one procedure therein without consideration of what Carles et al teach in its entirety to one of ordinary skill in the art.

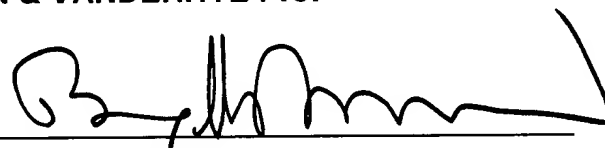
The present applicants' claims relate to an elemental **chlorine-free** bleaching sequence – i.e., one in which no chlorine gas is used. Thus, claims 25, 38, 33, 40, 41 are patentable over references cited by the Examiner.

Every effort has been made to advance prosecution of this application to allowance. Therefore, in view of the amendments and remarks above, applicants suggest that this application is in condition for allowance and Official Notice to that effect is solicited.

Respectfully submitted,

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APPENDIX I

Marked-Up Version of Amended Claims Pursuant to 37 CFR §1.121(c)

21. (Twice Amended) A method of treating chemical cellulose pulp from an alkaline pulping process with chlorine dioxide in a first chlorine dioxide stage of an elemental chlorine free bleaching sequence, comprising:

- (a) bleaching the chemical cellulose pulp in a first chlorine dioxide step at a temperature over 70 °C for less than 10 minutes and so as to provide a chlorine dioxide dosage of between [about] 0.5-1.5 % active chlorine, and adjusting the pH of the pulp in the first chlorine dioxide step so that the final pH of the step is over 4; and then
- (b) effecting an acid treatment of the chemical cellulose pulp from step (a) at a pH of between 2 – 5 and at a temperature of over 80°C and a time of [for] 30-300 minutes sufficient to remove hexenuronic acids from the pulp.

35. (Twice Amended) A method of treating chemical cellulose pulp from an alkaline pulping process with chlorine dioxide in a first chlorine dioxide stage of an elemental chlorine free bleaching sequence, comprising:

- (a) bleaching the chemical cellulose pulp in a first chlorine dioxide step so that the final pH of the step is over 5, and so as to provide a chlorine dioxide dosage of between about 0.5-1.5 % active chlorine and so that hexenuronic acid groups in the pulp substantially do not react with chlorine dioxide, and for a treatment time of between 30 seconds-three minutes and at a temperature of over 75 °C; and then
- (b) acid treating the chemical cellulose pulp from step (a) at a pH of between 2 – 5 and at a temperature of over 80°C for 30-300 minutes.

39. (Twice Amended) A method of treating chemical cellulose pulp from an alkaline pulping process with chlorine dioxide in a first chlorine dioxide stage of an elemental chlorine free bleaching sequence, comprising:

- (a) bleaching the chemical cellulose pulp in a first chlorine dioxide step at a temperature of over 70 °C and for less than 10 minutes, and adjusting the pH of the pulp in the first chlorine dioxide step so that the final pH of the step is over 4, then
- (b) acid treating the chemical cellulose pulp from step (a) at a pH of between 2 – 5 and at a temperature of over 80°C for 30-300 minutes, and
- (c) after (b) bleaching the chemical cellulose pulp in a second chlorine dioxide step; and

wherein (a) is further practiced so as to provide a chlorine dioxide dosage of between about 0.1-1.0% active chlorine during the first chlorine dioxide step; and wherein (c) is practiced so as to provide a chlorine dioxide dosage of between about 0.5-2.0% active chlorine during the practice of the second chlorine dioxide step.